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This fact is not yet verified sufficiently, but it is in accordance with correct theory. It is a negative fact in favor of this, that so far coal (lignite) has not been found (or only slight traces of it) in the borings that have been made from the levels of the high prairie through the Benton to the Dacotah, as in the artesian boring at Russell city.

If the Dacotah period was characterized by a shallow sea with sandbars and low islands and peninsulas, with these sub-aërial parts clothed with forest, and if the total deposit does not exceed five hundred feet in thickness, as Prof. Mudge gives, and as is very probable,* it would not be expected that carbonaceous deposits would be sufficient to give a bed of coal in the earlier half of the period. Where the deposits of dicotyledonous leaves extend through a considerable vertical mass, it would suggest the possibility of a lignitic deposit near. But this is not verified by observation. The famous deposits of leaves are not in the neighborhood of the lignite, and the thick, massive sandstones of the Dacotah are all below the horizon of the lignitic coal. That the sand deposits were not favorable to the fossilizing of organic forms is well known, and hence there are comparatively few occurrences of fossil wood in the Dacotah. In the lower beds of the Benton there is abundance of it. The specimens are calcareous petrifactions. It is manifest that they represent wood of the Dacotah period, probably of the lignitic horizon, water-logged and imbedded in the calcareous mud of the early Benton seas. There is none in the upper Benton.

There is one other fact that will possibly be of importance in the development of the lignitic horizon in southwest Kansas. In the area in which the Dacotah is known in Kansas there is undoubtedly a change of dip from westerly to easterly in the great body of the formations. We have previously pointed out that this would have a bearing on the water supply of western Kansas, and recent artesian borings at Coolidge and Fowler confirm our judgment. In the Arkansas valley and further south it will have a bearing on the probable supply of lignite for fuel or use in sugar manufacture, for which Prof. Swenson has pointed out its value. The easterly dip of the strata in the valley of the great river is not much different from the slope of the stream. The effect of this is to keep the lignitic horizon not far from the surface over an immense area. In a part of the southwest the cretaceous formations are hidden by the two tertiary deposits, and it may be that they have, by preventing percolation and by added pressure, preserved areas of lignite of better quality than any yet found. Of course the drill only can settle this, but the areas in which it is probable or possible can be approximately determined.

NOTE.—The published record of a drill-hole at Cawker City suggests some exception to be made to some of the conclusions of this paper; but there are some grounds to suspect the accuracy of that record, and in the absence of confirmatory evidence we leave the present discussion of its bearings. Recent discovery by Prof. Hill of another cretaceous horizon in Texas, and the Texan character of the shell bed in Barber county, suggest a possible change in the horizon of the southern lignite which must be determined by further investigation; but it is certain that the horizon exists in the Dacotah as black shale in the more western counties south of the Arkansas river, as Morton and Stanton.

ON THE NEWLY-DISCOVERED SALT BEDS IN ELLSWORTH COUNTY, KANSAS.

BY E. H. S. BAILEY, PH.D.

That there are salt beds underlying many portions of this State, seems to have been recognized for many years. Where deep wells have been sunk the flow of salt water is often abundant, and as we go farther west, the salt waters are nearer the surface. At Geuda Springs, in Cowley county, and in several other places farther west, brine springs often occur.

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*The Russell boring does not give more than 375 feet for the thickness of the Dacotah.

A company was formed at Ellsworth the past summer for the purpose of boring a well. The drilling was begun on August 30. The following is a record of the strata, as reported by Col. H. G. Johnston, the contractor:

SURFACE.

	Feet.
Yellow clay	40
Sand and gravel	12
Red clay	35
Gray soapstone	53
Gray sand-rock	25
Blue clay (impregnated with iron pyrites)	10
Gray soapstone	25
White sand-rock (artesian water)	50
Gray sand-rock	15
Light-red shale	40
Dark-red shale	165
Gray shale	60
Red shale	20
Gray shale	10
Rock salt (salt)	50
Gray slate	5
Rock salt (salt)	90
Light-gray slate	5
Dark shale	5
Medium-dark shale	20
Light and dark slate	30
Gypsum	30
Gray slate	45
Light-gray slate	15
Dark shale	40
Light shale	5
Dark slate	15
Light slate	15
Dark slate	10
Light sand	5
Light-red shale	65
Dark-gray sand (gas)	20
Gray sandy shale	100
Light sand-rock (salt water)	20

It will be seen by reference to this record that at a depth of 730 feet rock salt was struck in two layers, one fifty and the other ninety feet in thickness, with five feet of gray slate intervening. The salt bed is therefore 140 feet thick. The salt is hard, dry and crystalline, and has the following composition:

	Per cent.
Sodium chloride	95.76
Water	.19
Calcium sulphate	1.21
Calcium chloride	.99
Magnesium sulphate	.09
Potassium chloride	.67
Insoluble matter	.27
Calcium carbonate	a trace.

The sample examined was taken up with the drillings, and was of course somewhat contaminated with scrapings from the slate and shale above. If we consider the potassium chloride as salt, for in most analyses it is so reckoned, it will be seen that the total impurities amount to about three and one half per cent. This be it remembered, is not a manufactured article, nor is it quite as pure as the original salt beds from which it comes. A little of the salt was dissolved in water, filtered, and evaporated to dryness. No attempt was made to separate any of the insoluble material from this. This process gave the pure white sample in the bottle marked No. 2. This contains about 97½ per cent. of salt.

I have compared this analysis with that of some samples of manufactured salt reported by Dr. Motte, Prof. Goesmann and others. These manufactured salts represent much labor and fuel. They are usually made from salt waters, and the more insoluble impurities have been allowed to crystallize out. Sometimes solar heat is used for evaporation, and sometimes the brines are evaporated by steam or over an open fire in kettles. Notwithstanding this process the per cent. of salt is only the following:

	Per cent.
Higgin's	97.8
Onondaga	97.7
Ashton's	97.6
Deckin's	97.5
Worthington	97.4

So it will be seen that the Ellsworth product compares very favorably with these and it can be obtained with only the labor of mining and hoisting to the surface.

The drilling of the well has been continued. At 1280 feet considerable gas was struck. It is proposed to continue the boring to a depth of 1600 feet or more. A similar bed of rock salt has been struck at Hutchinson, and from published reports it is about as pure as the Ellsworth sample.

UNIVERSITY OF KANSAS, Oct. 1887.

SOME EXPERIMENTS ON THE RELATION BETWEEN THE TASTE AND THE ACIDITY OF CERTAIN ACIDS.

BY E. H. S. BAILEY, PH. D.

Some tests have previously been made on the "Delicacy of the Sense of Taste."* The following experiments were suggested in continuation of the same general subject. Normal solutions of the following acids were prepared: Sulphuric, Hydrochloric, Nitric, Tartaric, Citric, and Acetic. These solutions were diluted so as to make six series; each solution in a series being of one half the strength of the preceding one. The dilution was continued until it was impossible to taste the acid. The stronger numbers of each series were set aside, and the bottles containing the solutions together with some bottles containing water were placed without regard to order upon the table.

Tests were then made upon these solutions by twenty persons, including some of both sexes. By tasting of these solutions they divided them into two classes, water and acid. The more dilute solutions they usually set aside and tasted a second time, in order to confirm or disfirm or disaffirm the first impression.

There was remarkable uniformity in the results. As the solutions were of the same acidimetric strength, it was possible to compare them exactly. In nearly all cases the solution which was $\frac{1}{128}$ of the normal was the most dilute that could be tasted. This was especially true of the mineral acids. In quite a large number of cases the solution which was $\frac{1}{64}$ of the strength of the normal was the most dilute *organic* acid detected.

There seems to be, therefore, a slightly greater ability to taste the mineral than the organic acids. Whether this is due to some special or characteristic taste of the former, or to its greater persistence, cannot be determined. No attempt was made to name the different acids when thus diluted, and indeed it would require greater delicacy of taste than is usually possessed.

It was noticed that after standing a short time a variety of molds developed in the dilute organic acid solutions. These were kindly examined for me by Mr. V. L. Kellogg. He noticed especially that there seemed to be some special variety of plant which was the *prevalent* form in each acid, although this did not prevent some specimens of other species from being also present. As the molds developed, the acids lost their strength, as measured by the sense of taste, so that after several weeks no acid could be detected in several of the more dilute solutions. There is no doubt but that the vegetable forms grow at the expense of the organic acids, but how the acids are broken up, and what conditions are necessary, we have not yet determined.

These tests seem to show that the method adopted in the taste experiments is in general an accurate one. Also in this particular case the acid taste corresponds with the actual amount of acid present as determined by saturation with an alkali.

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*On the Delicacy of the Sense of Taste, by E. H. S. Bailey and E. L. Nichols: *Science*, March, 1888; also, *Nature*, March, 1888.